Incident Learning Systems in Radiation Therapy: Role of Culture and Potential Benefits

Sasa Mutic

Department of Radiation Oncology
Mallinckrodt Institute of Radiology
Washington University
St. Louis, MO
Conflict of Interest

• Director – TreatSafely.org
• Grant on incident learning in RT - Varian Medical Systems
• Potential grant on incident learning systems in RT – Elekta/Varian Medical Systems
• Partner – Radialogica, LLC
Learning Objectives

1. Describe use of incident learning systems in RT
2. Describe role of organizational culture in patient safety
3. Describe potential benefits of near miss and error data in RT
Introduction

Event 6052 has been submitted and is ready for review. Click here to do so.

Event Date: 1/20/2012
Event Narrative: BID patient was not added to QC for chart check after 1st fx.
Area: Physics - Quality Assurance
Is there a benefit in every size facility?

• Relatively good communications
• Streamlined processes
• Great collective memory
• Perhaps a limited benefit

Single Machine Facility
Is there a benefit in every size facility?

- Non-uniform communications
- Complex processes
- Pockets of reliable memory
- Potentially significant benefits

Large Facilities
WU – 350 Faculty and Staff
Is there a benefit in every size facility?

- Still silos
- Non-uniform processes
- Unawareness
- Potentially significant benefits

Networks
Errors in Radiation Therapy

- Staff and public exposures
- Misadministrations
  - Underdose
  - Overdose
  - Anatomical misses
- Magnitude
  - From few percent to lethal doses
  - From couple of millimeters to complete misses
- Regulatory
  - Nuclear Regulatory Commission
  - Errors that do not necessarily affect patients but have regulatory/legal consequences

- Sources
  - Staff
  - Software
  - Hardware
- Random
  - Affect one to few patients
- Systematic
  - Affect hundreds of patients
  - Potentially in a short period
Error spectrum

• **Publicized** - One side of the spectrum, usually large dosimetric errors – NY Times Articles

• **Semi-publicized** – RPC data
  • Approximately 30% of *participating* institutions fail to deliver IMRT dose indicated in their treatment plans to within 7% or 4mm to an anthropomorphic phantom (IJROBP. 2008;71(1 Suppl):S71-5).

• **Unpublicized/unnoted** – everyday occurrences
  • “Small” dosimetric errors and geographic misses
  • Suboptimal treatment plans (contouring and dose distributions)
  • Care coordination issues
  • Unnecessary treatment delays
National Event Reporting Database
One of ASTRO’s Initiatives

Each clinic with its own independent database and varied software

Manufacturers
Regulatory Agencies
Professional Societies

Centralized Database

You and Your Facility
Event Reporting

- We are not airline industry nor nuclear power
- Perfection in complex systems across hundreds of diverse clinics is impossible
- Reporting systems for sake of reporting alone are a great way to squander resources and demoralize staff
- Error reporting as a part of broader process improvement efforts can be very valuable
DMAIC Cycle
# DMAIC Cycle

<table>
<thead>
<tr>
<th>Define</th>
<th>Measure</th>
<th>Analyze</th>
<th>Improve</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 0</td>
<td>Step 1</td>
<td>Step 3</td>
<td>Step 6</td>
<td>Step 9</td>
</tr>
<tr>
<td>Step 2</td>
<td>Step 2</td>
<td>Step 4</td>
<td>Step 7</td>
<td>Step 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Step 5</td>
<td>Step 8</td>
<td>Step 11</td>
</tr>
<tr>
<td>Select a Project</td>
<td>Establish Performance Parameters</td>
<td>Establish Process Baseline</td>
<td>Explore Potential Causes</td>
<td>Validate Measurement System for ‘X’</td>
</tr>
<tr>
<td></td>
<td>Validate Measurement System for ‘Y’</td>
<td>Define Performance Goals</td>
<td>Establish Variable Relationship</td>
<td>Verify Process Improvement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Identify Variation Sources</td>
<td>Design Operating Limits</td>
<td>Implement Process Controls</td>
</tr>
</tbody>
</table>
Opportunities

• Better insight into processes
• Education – “I did not know that!”
• Resource and effort allocation
• Overall quality improvement
  • Definition of quality?
    • Safe treatments
    • Minimal variations - Benchmarking
    • Positive patient experience
    • Positive employee experience
• Quality as a revenue center
Process Itself Matters


• Stable and well defined processes enable
  • Standardization
  • Quantification
  • Benchmarking
  • Improvements
  • Quality Control
Two Opportunities

The Goal

Normative decision theory:
Start with efficiency move
to efficacy
Event Reporting

- Mandatory (statutory)
  - Reporting required by law
  - NRC and certain states in U.S.
  - Well defined *treatment delivery* errors
  - Near-miss reporting typically not included

- Voluntary
  - Mainly at institutional level
  - Some states in the U.S. have voluntary reporting systems – utility for RT unclear
  - A spectrum of issues tracked
Statutory Reporting

• Largely independent of culture – motivated by law
• Training well defined and mandated
• Support resources mandated
• Standardized approach
Voluntary Reporting
Dependent on Many Factors

- Culture
- Reporting guidelines
- Reporting system
- Competence to interpret reported data
- Commitment to improvement
- Feedback and benefits to the reporting community
Organizational Culture

• “Shared values (what is important) and beliefs (how things work) that interact with an organization’s structures and control systems to produce behavioural norms (the way we do things around here).” Uttal, B., Fortune. 17 October 1983.

• Safety culture
  • Reporting culture
  • Just culture
Reporting Culture

- Indemnity against disciplinarily proceedings and retribution
- Confidentiality
- To the extent practical, separation of those collecting the event data from those with the authority to impose disciplinary actions
- An efficient method for event submission
- A rapid, intelligent, and broadly available method for feedback to the reporting community
Just Culture
Acceptable and Unacceptable Actions

• Vast majority of errors is due to factors and actions where attribution of blame is not appropriate nor useful
• Rare events are due to unacceptable actions:
  • Recklessness
  • Negligent or malevolent behavior
• The line between these can be thin and the tendency is to attribute errors to acceptable actions
• It is operationally impossible to give a blanket immunity which would include unacceptable actions
Lessons Learned
Naming a Voluntary Reporting System

• We often name our homegrown software by what it does
• Our brand new web-based system, back in 2007, was named “Process Improvement Logs”

• Our staff quickly provided a nickname

“E-Snitch”
Deemphasize “Snitch” Part

Report an Event
Report an issue that has caused harm to a patient or co-worker (e.g., incorrect dose given to patient, beam stayed on too long)

Report an Accolade
Report about someone doing something nice or helpful (e.g., covering a shift, helping with a patient)

Manager Area
From here managers can update/close an event and route them to other managers. You can also invite other people to view the event and give feedback.

Reporting
From here we can view reports and analyze the data.
Learning From Our Mistakes: Radiation oncology reporting survey

• Multi-institutional,* IRB-approved
  – Surveymonkey®, Anonymous, Dec-Jan 2011
    – Johns Hopkins
    – Washington University
    – University of Miami
    – North Shore-Long Island Jewish Hospital

Harris et al
Survey Summary

- Mistakes happen (at all institutions)
- Consensus: It is our responsibility to report
- Physicians participation poor everywhere
- All team members admit ‘reporting gap’
  - Knowing what to report/being too busy less important
  - Need help ‘knowing how’
  - Embarrassment critical
- Residents perceive the most barriers overall
- Support for a national reporting effort exists
Potential benefits - Example

QA/QC EFFECTIVENESS COMPARISON
Common QA Checks

• An analysis of the effectiveness of common QA/QC checks
• IRB between JHU & Wash U
• Both institutions started similar databases at the same time
• Data:
  • Incident reports: 2007-2011
  • 4,407 reports
  • 292 (7%) “high potential severity”

Ford, Mutic, et al. ASTRO & AAPM 2011, manuscript submitted for publication
Common QA checks

- Physics chart review
- Therapist chart review
- Physics weekly chart check
- Physician chart review
- EPID dosimetry
- Port films: check by therapist
- Timeout by the therapist
- Port films: check by physician
- In vivo diode measurements
- Checklist
- Chart rounds
- Online CT: check by therapist
- SSD check
- Online CT: check by physician
- Pre-treatment IMRT QA

Sensitivity (%)
How effective are combined checks?

For example:
- Pacemaker failure
- Immobilization failure
- Duplicated records

Ford, Terezakis, Mutic, manuscript submitted
Patient safety grant funded by Varian

- Sharing of event statistics with Varian
- Analysis of tools and preventive measures based on the collected data
- Feedback on their efforts based on the collected data
Potential benefits - Example

CHART CHECKS
Physics Checks

- Review plan on screen for unusual cases
- Review content of hardcopy information
  - Single cut isodoses
  - DVHs
  - Beam page
- Limited insight into actual delivery

Early 2000’s
Physics Checks late ~2007
Potential benefits - Example

AUTOMATIC CHECKS
Current IMRT QA Paradigm

1. Transfer patient plan to a QA phantom
   • Dose recalculated (homogeneous) on phantom – any dose calculation errors would not be revealed

2. Perform QA prior to treatment
   • Subsequent data changes/corruption may result in systematic errors for all subsequent patients

3. The volume of data impossible to monitor and verify manually
   • Manual checks do reveal data changes/corruptions, but not reliably

4. The process too laborious with questionable benefits
   • A systematic analysis and redesign demonstrates the possibility of a much more robust and automated process
ADQ – QA Every Day – All Patients
RESOURCES

A Reference Guide for Learning from Incidents in Radiation Treatment
Improving Quality and Safety in Radiation Therapy

TreatSafely is a not-for-profit organization dedicated to the development of novel teaching and mentoring programs that improve quality and safety in radiation medicine.

TreatSafely Workshop in Sao Paulo, Brazil - Feb 6-7, 2012

We are very pleased to announce that the Brazilian Association of Medical Physics (ABFM) has invited TreatSafely to present its Minimizing Errors, Maximizing Quality Workshop in beautiful, vibrant Sao Paulo, Brazil.

This two-day, extremely interactive workshop is designed to equip participants with the tools and skills required to develop and implement effective, efficient quality and safety programs.

Registration for the workshop is being handled directly by the ABFM. Please contact Laura Fumari (laurafumari@hotmail.com) for registration details.

Signup for Updates

Let us keep you up-to-date and in the loop. Enter your email address below to receive news and updates regarding upcoming workshops and online learning opportunities.

email: 

Signup
Welcome to TreatSafely's Quality Improvement ToolBox

The quality improvement tools presented here are designed to provide an easily accessible, simple to use mechanism for implementing an effective, efficient quality and safety program in your Institution.

Developing such a program from scratch can be a daunting task. Wherever possible, we have tried to simplify the process. The basic concepts of when and how to use each of the tools are provided in summary format and step-by-step help sections guide you through the process.

To get started, you'll need to nominate a lead person from your institution (probably yourself), then register your institution using the form below, free of charge.

If you are already registered, simply login using the Login section on the right-hand side of this page.

If you are not comfortable using your real institution name, then simply use an alternate name. There are no obligations.
Introduction to Error Management - Online

Not everyone has the time to make it one of our workshops. In this online lecture series, we've condensed and summarized some of the basic concepts of error management.

Online Learning

Our online Introduction to Error Management course is available completely free of charge through our Knowledge Center!

We have developed a set of four introductory modules that work through the following concepts, demonstrating their utility, and identifying their weaknesses:

- Overview
- Human Factors
- Error Management Techniques
- Quality and Safety

Each module is comprised of 2 fifteen-minute presentations, and 2 multiple-choice quizzes. Registration is free and allows you access to the full course content. Upon successful completion of all quizzes, a certificate of completion is available for download.

Workshops

Our Minimizing Errors, Maximizing Quality Workshops are intensive, extremely interactive, and a whole lot of fun.

Check out our Workshops section to learn more about our workshops, including upcoming workshop dates and a sample schedule.
Future Developments

• Event reporting as a part of OIS
Conclusions

• Persistent cultural/organizational emphasis
• Early victories
• Focus studies
• Culture as a broader field emphasis
Acknowledgments

• Scott Brame, Ph.D.
• Eric Ford, Ph.D.
• Stephanie Terezakis, M.D.
• Hiram Gay, M.D.
• Kendra Harris, Ph.D.
• Jason LaBrash
• Lakshmi Santanam, Ph.D.
• Jonathan Danieley
• Peter Dunscombe, Ph.D.
• Derek Brown, Ph.D.
• Todd Pawlicki, Ph.D.